IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of: §
§
Balachandar Varatharajan et.al.
§ Group Art Unit: 1745
Serial No.: 10/681,704 §

Examiner: Alejandro, Raymond

Filed: 10/09/2003 §

§
For: INTEGRATED FUEL CELL HYBRID POWER PLANT WITH CONTROLLED OXIDANT FLOW FOR COMBUSTION OF SPENT FUEL § Atty. Docket: 124411
§

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Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

APPEAL BRIEF PURSUANT TO 37 C.F.R. §§ 41.31 AND 41.37

This Appeal Brief is being filed in furtherance to the Notice of Appeal received by the Patent Office on March 19, 2007.

The Commissioner is authorized to charge the requisite fee of $500.00, and any additional fees, which may be necessary to advance prosecution of the present application, to Account No. 07-0868.

1. REAL PARTY IN INTEREST

The real party in interest is General Electric Company, the Assignee of the above-referenced application by virtue of the Assignment to General Electric Company by Varatharajan Balachandar, Balan Chellappa and Dey Debashis recorded at reel 014604, frame 0143, and dated October 9, 2003. Accordingly, General Electric Company, as the parent company of the Assignee of the above-referenced application, will be directly affected by the Board's decision in the pending appeal.

2. **RELATED APPEALS AND INTERFERENCES**

Appellants are unaware of any other appeals or interferences related to this Appeal. The undersigned is Appellants' legal representative in this Appeal.

3. **STATUS OF CLAIMS**

Claims 1-8, 12-14, 17, 18, 20 and 27 are currently pending, are currently under final rejection and, thus, are the subject of this Appeal.

4. **STATUS OF AMENDMENTS**

As the instant claims have not been amended in the last office action response, there are no outstanding amendments to be considered by the Board.

5. **SUMMARY OF CLAIMED SUBJECT MATTER**

This invention relates generally to power plants,. *See* Application page 1, paragraph [0001]. More particularly, the disclosed system relates to hybrid power plants with integrated fuel cells, where the controlled injection of exhaust air from the fuel cell is used to burn the spent fuel from the fuel cells. *See id* at page 1, paragraph [0001].

The Application contains two independent claims, namely, claims 1 and 27, all of which are the subject of this Appeal. The subject matter of these claims is summarized below.

With regard to the aspect of the invention set forth in independent claim 1, discussions of the recited features of claims 1 can be found at least in the below cited locations of the specification. By way of example, Figure 1 schematically illustrates an exemplary integrated gas turbine and fuel cell hybrid power plant 10 including a fuel cell portion 31 and a turbine portion 13 for producing electricity in tandem with one another.

The turbine portion 13 typically includes a compressor 12, a turbine 14, a rotor 16 by which turbine 14 drives compressor 12, an electrical generator 18, and a recuperator 20. The fuel cell portion 31 typically includes a fuel pump 30, a de-sulfurizer 32, a fuel cell assembly 34, a fuel reformer 36 for fuel cell assembly 34 and a tail gas burner 38 (hereinafter TGB). *See* e.g., page 3, Paragraph 13.

Compressor 12 inducts air and produces a compressed air stream 40 at an outlet 11 of compressor 12. The compressed air stream 40 is directed towards recuperator 20, which recuperator 20 is a known type of heat exchanger including isolated flow paths. Compressed air stream 40 enters recuperator 20 in a first recuperator flow path 41, and a turbine exhaust stream 42 is passed into recuperator 20 in a second recuperator flow path 43, whereby heat from the turbine exhaust 42 is transferred to the compressed air stream 40 from the compressor outlet 11 without mixing of the compressed air stream 40 and the turbine exhaust stream 42. Compressed air stream 40 is heated within recuperator 20 by the turbine exhaust stream 42, and a heated compressed air stream 44 exits recuperator 20 and flows to a cathode inlet 46 of fuel cell assembly 34 to provide an oxidant thereto. *See* paragraph 14 page 4.

The heated compressed air stream 44 from the recuperator 20 enters the fuel cell assembly 34 through cathode inlet 46 and flows through the fuel cell units in the fuel cell assembly 34. At least a portion of the fuel reacts electrochemically with the oxidant air flowing through the fuel cell assembly to produce electricity. Spent air 54 is exhausted from fuel assembly 34 through cathode outlet 48 and is designated as cathode exhaust stream 54. *See* paragraph 17 page 5.

By controlling the injection of spent air 62 and exhausted fuel 60 in tail gas burner 38, it can be ensured that the fuel/air mixture is lean and within flammability limits. Thus, all of the fuel components remaining in the spent fuel stream 60 are combusted in the tail gas burner 38, thereby fully utilizing the fuel in the system and preventing discharge of unburned fuel and carbon monoxide in exhaust 114 from the plant 10. *See* paragraph 21 page 7.

Figure 4 shows a diagrammatical view of an exemplary embodiment of the TGB 38. The TGB 38 is designed to handle fuel with very low heat content. The TGB 38 is divided into two zones, a primary zone 86 and a secondary zone 88. See Paragraph 23, page 8. The mass of air injected into the primary zone 86 may be less than about 20% of the total cathode exhaust stream 54. Accordingly the mass of air injected into the secondary zone may vary from about 5% to about 100% of the cathode exhaust stream 54. *See* paragraph 26 page 9.

With regard to the aspect of the invention set forth in independent claim 27, discussions of the recited features of claim 27 can be found at least in the below cited locations of the specification. By way of example, Figure 1 schematically illustrates an exemplary integrated gas turbine and fuel cell hybrid power plant 10 including a fuel cell portion 31 and a turbine portion 13 for producing electricity in tandem with one another. The turbine portion 13 typically includes a compressor 12, a turbine 14, a rotor 16 by which turbine 14 drives compressor 12, an electrical generator 18, and a recuperator 20. The fuel cell portion 31 typically includes a fuel pump 30, a de-sulfurizer 32, a fuel cell assembly 34, a fuel reformer 36 for fuel cell assembly 34 and a tail gas burner 38 (hereinafter TGB). *See* e.g., page 3, Paragraph 13.

Compressor 12 inducts air and produces a compressed air stream 40 at an outlet 11 of compressor 12. The compressed air stream 40 is directed towards recuperator 20, which recuperator 20 is a known type of heat exchanger including isolated flow paths. Compressed air stream 40 enters recuperator 20 in a first recuperator flow path 41, and a turbine exhaust stream 42 is passed into recuperator 20 in a second recuperator flow path 43, whereby heat from the turbine exhaust 42 is transferred to the compressed air stream 40 from the compressor outlet 11 without mixing of the compressed air stream 40 and the turbine exhaust stream 42. Compressed air stream 40 is heated within recuperator 20 by the turbine exhaust stream 42, and a heated compressed air stream 44 exits recuperator 20 and flows to a cathode inlet 46 of fuel cell assembly 34 to provide an oxidant thereto. *See* paragraph 14 page 4.

The heated compressed air stream 44 from the recuperator 20 enters the fuel cell assembly 34 through cathode inlet 46 and flows through the fuel cell units in the fuel cell assembly 34. At least a portion of the fuel reacts electrochemically with the oxidant air flowing through the fuel cell assembly to produce electricity. Spent air 54 is exhausted from fuel assembly 34 through cathode outlet 48 and is designated as cathode exhaust stream 54. *See* paragraph 17 page 5.

By controlling the injection of spent air 62 and exhausted fuel 60 in tail gas burner 38, it can be ensured that the fuel/air mixture is lean and within flammability limits. Thus, all of the fuel components remaining in the spent fuel stream 60 are combusted in the tail gas burner 38, thereby fully utilizing the fuel in the system and preventing discharge of unburnt fuel and carbon monoxide in exhaust 114 from the plant 10. *See* paragraph 21 page 7.

Figure 4 shows a diagrammatical view of an exemplary embodiment of the TGB 38. The TGB 38 is designed to handle fuel with very low heat content. The TGB 38 is divided into two zones, a primary zone 86 and a secondary zone 88. See Paragraph 23, page 8. The mass of air injected into the primary zone 86 may be less than about 20% of the total cathode exhaust stream 54. Accordingly the mass of air injected into the secondary zone may vary from about 5% to about 100% of the cathode exhaust stream 54. *See* paragraph 26 page 9.

In an exemplary embodiment, fuel cell assembly 34 comprises a plurality of solid oxide fuel cell (SOFC) units. *See* Paragraph 15, page 4.

A benefit of the invention, as illustrated in power plants 10, 200 and 300 provide better overall plant performance in relation to known systems while providing thermal efficiency and improved temperature control of the fuel cell assembly through re-circulation flow paths and while avoiding complexity and costs of conventional heat exchangers to maintain the fuel cell assembly at desired temperatures. The controlled injection of the oxygen depleted spent air 64 in the tail gas burner 38 enhances the performance of the hybrid power plants in all the embodiments described above. In hybrid power plant 300, re-circulation of fuel cell assembly cathode exhaust also facilitates inlet air temperature control to the fuel cell assembly, which, in turn, provides for more precise control of temperature rise and uniformity within the fuel cell assembly. Re-circulation of fuel cell assembly cathode exhaust provides increased turbine section inlet temperature to provide more work in the turbine, provides for increased performance retention via reduced cathode side oxidation, permits fuel cell assembly operation at stoichiometric conditions, and simplifies exhaust after-treatment before discharging plant exhaust to the atmosphere.

This is a clear difference and distinction from the prior art, as discussed below.

6. GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

First Ground of Rejection for Review on Appeal:

Appellants respectfully urge the Board to review and reverse the Examiner's first ground of rejection in which the Examiner rejected Claims 1-8 12-14, 17-18, 20 and 27 as being anticipated by Domeracki et al., U.S Patent 5,413,879 (hereinafter Domeracki).

Second Ground of Rejection for Review on Appeal:

Appellants respectfully urge the Board to review and reverse the Examiner's second ground of rejection in which the Examiner rejected Claim 1-9, 12-14, 17-18, 20 and 27 as unpatentable over Domeracki in view of Rosen at al. US Patent Number 6213234 (herein after Rosen).

7. **ARGUMENT**

As discussed in detail below, the Examiner has improperly rejected the pending claims. Further, the Examiner has misapplied long-standing and binding legal precedents and principles in rejecting the claims under Sections 102 and 103. Accordingly, Appellants respectfully request full and favorable consideration by the Board, as Appellants strongly believe that claims 1-9, 12-14, 17-18, 20 and 27 are currently in condition for allowance.

A. **Ground of Rejection No. 1:**

Claims 1-8 12-14, 17-18, 20 and 27 have been rejected as being anticipated by Domeracki et al., U.S Patent 5,413,879 (hereinafter Domeracki). While the Examiner rejected each of independent claims 1 and 27 on the basis of U.S Patent 5,413,879, each of these independent claims will be discussed separately below. Appellants respectfully traverse this rejection.

1. **Judicial precedent has clearly established a legal standard for a *prima facie* anticipation rejection.**

Anticipation under Section 102 can be found only if a single reference shows exactly what is claimed. *Titanium Metals Corp. v. Banner*, 227 U.S.P.Q. 773 (Fed. Cir. 1985). Thus, for a prior art reference to anticipate under Section 102, every element of the claimed invention must be identically shown in a single reference. *In re Bond*, 15 U.S.P.Q.2d 1566 (Fed. Cir. 1990). Moreover, the prior art reference also must show the *identical* invention "*in as complete detail as contained in the ... claim*" to support a *prima facie* case of anticipation. *Richardson v. Suzuki Motor Co.*, 9 U.S.P.Q. 2d 1913, 1920 (Fed. Cir. 1989) (emphasis added). Accordingly, Appellants need only point to a single element not found in the cited reference to demonstrate that the cited reference fails to anticipate the claimed subject matter.

2. **The Examiner's rejection of claim 1 and 27 is improper because the rejection fails to establish a *prima facie* case of anticipation.**

Independent claim 1 and 27 recite:

1. A hybrid power generation system for generating electrical power comprising:

a compressor for producing a compressed oxidant;

a recuperator in flow communication with said compressor;

a fuel cell assembly comprising a plurality of fuel cells in flow communication with said recuperator to provide the compressed oxidant for said fuel cell assembly, said fuel cell assembly further comprising a cathode inlet for receiving the compressed oxidant, an anode inlet for receiving a fuel stream, an anode outlet in flow communication with an anode exhaust stream and a cathode outlet in flow communication with a cathode exhaust stream; wherein at least a portion of the fuel steam reacts with the oxidant to produce electrical power;

a tail gas burner in fluid communication with the anode outlet and the cathode outlet; said tail gas burner configured for combusting a mixture of at least a portion of the anode exhaust stream and at least a portion of the cathode exhaust stream and producing a hot compressed gas, wherein the tail gas burner comprises a primary zone and a secondary zone;

a control system for controlling the amount of the cathode exhaust stream introduced in the tail gas burner for stable combustion and reduction of fuel and carbon monoxide emission, wherein less than 20 percent of the cathode exhaust stream by mass is diverted to the primary zone of the tail gas burner and about 5 percent to about 100 percent of the cathode exhaust stream by mass is diverted to the secondary zone of the tail gas burner; and

a turbine expanding said hot compressed gas and producing electrical power and an expanded gas.

27. A hybrid power generation system for generating electrical power comprising:

a compressor for producing compressed air;

a recuperator in flow communication with said compressor;

a solid oxide fuel cell assembly comprising a plurality of solid oxide fuel cells in flow communication with said recuperator to provide the compressed oxidant air for said solid oxide fuel cell assembly, said fuel cell assembly further comprising a cathode inlet for receiving the compressed air, an anode inlet for receiving a fuel stream, an anode outlet in flow communication with an anode exhaust stream and a cathode outlet in flow communication with a cathode exhaust stream; wherein at least a portion of the fuel stream reacts with the air to produce electrical power;

a tail gas burner in fluid communication with the anode outlet and the cathode outlet; said tail gas burner configured for combusting a mixture of at least a portion of the anode exhaust stream and at least a portion of the cathode exhaust stream and producing a hot compressed gas, wherein the tail gas burner comprises a primary zone and a secondary zone;

a control system for controlling the amount of the cathode exhaust stream introduced in the tail gas burner for stable combustion and reduction of fuel and carbon monoxide emission, wherein less than 20 percent of the cathode exhaust stream by mass is diverted to the primary zone of the tail gas burner and about 5 percent to about 100 percent of the cathode exhaust stream by mass is diverted to the secondary zone of the tail gas burner; and

a turbine for expanding said hot compressed gas and producing electrical power and an expanded gas.

a. Domeracki does not disclose either a tail gas burner or a control system

Domeracki describes an improved integrated gas turbine solid oxide fuel cell system. The system has a compressor for producing compressed air that is pre-heated and then supplied to a solid oxide fuel cell generator. The solid oxide fuel cell generator, which is also supplied with a first stream of fuel, produces electrical power and a hot gas. In the solid oxide fuel cell generator, the un-reacted portion of the fuel is combusted with the oxygen remaining in the hot gas to further heat the hot gas. The further heated hot gas is then directed to a topping combustor 8 that is supplied with a second stream of fresh fuel 44 (in addition to the fuel content in the stream 24) so as to produce a still further heated hot gas that is then expanded in a turbine. As mentioned by the Examiner in page 4 second paragraph of the office action that topping combustor 8 can act as tail gas burner, the Appellants humbly submit that the topping combustor 8 runs on additional fresh fuel supply 44 along with the exhaust 24 coming from the combustion chamber 7 and therefore can not be equivalent to a tail gas burner as described in the present application. Domeracki furthermore does not describe a control system for controlling anode and cathode exhaust from the fuel cell (as discussed by the Examiner in pages 4-6 of the office action). As shown in Fig. 3 of Domeracki, the spent fuel 45 mixes with the hot gas 23 discharging from the fuel cells 50 (col. 4, lines 26-28). Domeracki neither suggests nor discloses any split of fuel or air into primary and secondary zones of the tail gas burner as described in the claims 1 and 27 of the present application. Furthermore the function of the combustor 7 of Domeracki is also to heat the incoming air 22 (Col. 4 line 36) thereby decreasing the temperature of the hot gas 23, which is compensated by the topping combustor 8. Therefore the design and the fundamentals of the combination of the combustors 7 and 8 in Domeracki is completely different from the controlled combustion in the tail gas burner described in the present application.

Therefore as discussed above, in contrast to Domeracki, the present application describes a control system to split the cathode exhaust into two different streams and a controlled amount of oxidant is therefore sent to each of the primary and secondary zones of the tail gas burner (TGB 38) to reach a stable flame temperature and burn the un-reacted fuel in a lean condition in the TGB 38 to reduce the carbon monoxide emission. Domeracki does not describe such a control system as evident from the fact that the systems described by Domeracki need a top up combustor 8 to fully react the un-reacted fuels in the exit stream from the combustor 7 and also to reach the required temperature for the power generation in the gas turbine 2.

Therefore Domeracki neither discloses nor suggests all elements of the independent claims 1 and 27. Accordingly, because the reference fails to disclose each element recited by the instant claim, the Domracki reference fails to anticipate independent claims 1 and 27. Thus, the Examiner's rejection of independent claims 1 and 27 is clearly improper. Accordingly, the Appellants request the Board to overturn the rejection and allow independent claim 1 and 27 and the claims 9, 12-14, 17-18 and 20 that depend therefrom.

B. **Ground of Rejection No. 2:**

Claim 1-9, 12-14, 17-18, 20 and 27 are rejected as unpatentable over Domeracki in view of Rosen at al. US Patent Number 6213234 (herein after Rosen). Appellants respectfully traverse this rejection.

1. **Legal basis required to establish a *prima facie* case of obviousness.**

The burden of establishing a *prima facie* case of obviousness falls on the Examiner. *Ex parte Wolters and Kuypers*, 214 U.S.P.Q. 735 (B.P.A.I. 1979). Accordingly, to establish a *prima facie* case, the Examiner must not only show that the combination includes all of the claimed elements, but also a convincing line of reason as to why one of ordinary skill in the art would have found the claimed invention to have been obvious in light of the teachings of the references. *Ex parte Clapp*, 227 U.S.P.Q. 972 (B.P.A.I. 1985).

2. **The Examiner's rejection of independent claims 1 and 27 is improper because the rejection fails to establish a *prima facie* case of obviousness.**

Domeracki does not describe a control system to achieve flame stability and to reduce carbon monoxide emission. The Examiner has pointed out that the left side of tubular cell 50 of Domeracki can be considered as the primary zone. The primary zone in the present application is designed as the flame stabilization zone and the control scheme is configured to ensure the fuel/air mixture is lean and within flammability limits (as mentioned in paragraphs 21 and 23 of present application). Domeracki neither suggests nor discloses any scheme to control the flame stability in the process as described in the present application.

The Examiner pointed out in page 25 of the office action that Rosen describes a controller. Rosen describes a power controller 30 responsive to a control or demand signal to regulate the electric motor 18 and 18'. When the vehicle's power requirements exceed output capacity of the fuel cell, the power controller causes additional hydrocarbon fuel and compressed air to be supplied to the gas turbine to generate additional power (col. 3, line 26-30). The function of the power controller does not include regulating cathode exhaust to a combustor to control flame stability and reduce carbon monoxide. Rosen does not disclose or suggest use of any control scheme to be applied as described in the present application.

For at least these reasons, Appellant respectfully submits that Claims 1 and 27 are patentably distinguishable from the cited art, either alone or in combination. Accordingly, Appellant requests that the rejections of Claims 1 and 27 and the claims 9, 12-14, 17-18 and 20 that depend therefrom under 35 USC 103(a) be withdrawn. As such, the Appellants respectfully request that the Board direct the Examiner to allow the claims 1-9, 12-14, 17-18, 20 and 27.

Conclusion

Appellants respectfully submit that all pending claims are in condition for allowance. However, if the Examiner or Board wishes to resolve any other issues by way of a telephone conference, the Examiner or Board is kindly invited to contact the undersigned attorney at the telephone number indicated below.

Respectfully submitted,

Date: May 21, 2007

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8. APPENDIX OF CLAIMS ON APPEAL

Listing of Claims:

1. (previously presented) A hybrid power generation system for generating electrical power comprising:

a compressor for producing a compressed oxidant;

a recuperator in flow communication with said compressor;

a fuel cell assembly comprising a plurality of fuel cells in flow communication with said recuperator to provide the compressed oxidant for said fuel cell assembly, said fuel cell assembly further comprising a cathode inlet for receiving the compressed oxidant, an anode inlet for receiving a fuel stream, an anode outlet in flow communication with an anode exhaust stream and a cathode outlet in flow communication with a cathode exhaust stream; wherein at least a portion of the fuel stream reacts with the oxidant to produce electrical power;

a tail gas burner in fluid communication with the anode outlet and the cathode outlet; said tail gas burner configured for combusting a mixture of at least a portion of the anode exhaust stream and at least a portion of the cathode exhaust stream and producing a hot compressed gas, wherein the tail gas burner comprises a primary zone and a secondary zone;

a control system for controlling the amount of the cathode exhaust stream introduced in the tail gas burner for stable combustion and reduction of fuel and carbon monoxide emission, wherein less than 20 percent of the cathode exhaust stream by mass is diverted to the primary zone of the tail gas burner and about 5 percent to about 100 percent of the cathode exhaust stream by mass is diverted to the secondary zone of the tail gas burner; and

a turbine expanding said hot compressed gas and producing electrical power and an expanded gas.

2. (previously presented)The hybrid power generation system of claim 1, wherein the anode exhaust stream comprises a low heat content fuel configured to have a heat content.

3. (original) The hybrid power generation system of claim 2, wherein the heat content of the low heat content fuel is equal or less than about 250 BTU per cubic feet at standard conditions.

4. (original) The hybrid power generation system of claim 2, wherein the heat content of the low heat content fuel is equal or less than about 100 BTU per cubic feet at standard conditions.

5. (original) The hybrid power generation system of claim 1, wherein the cathode exhaust stream comprises oxygen in less than about 25 percent by volume.

6. (original) The hybrid power generation system of claim 1, wherein the oxidant is air.

7. (original) The hybrid power generation system of claim 6, wherein the cathode exhaust stream is an oxygen depleted air stream comprising oxygen in less than about 21 percent by volume.

8. (original) The hybrid power generation system of claim 1, wherein at least one portion of the compressed oxidant is diverted to the tail gas burner to provide cooling for the tail gas burner.

9. (cancelled)

10. (cancelled)

11. (cancelled)

12. (original) The hybrid power generation system of claim 1, wherein the anode exhaust stream is introduced into the tail gas burner through one or more nozzles.

13. (original) The hybrid power generation system of claim 1, wherein the fuel cell is selected from the group consisting of solid oxide fuel cells, proton exchange membrane fuel cells, molten carbonate fuel cells, phosphoric acid fuel cells, alkaline fuel cells, direct methanol fuel cells, regenerative fuel cells, zinc air fuel cells, and protonic ceramic fuel cells.

14. (previously presented)The hybrid power generation system of claim 1, further comprising a pre-reformer to reform the fuel stream.

15. (withdrawn) The hybrid power generation system of claim 1, wherein at least a portion of the anode exhaust stream is recycled to the inlet of the pre-reformer.

16. (withdrawn) The hybrid power generation system of claim 15, wherein the pre-reformer is an integral part of the fuel cell assembly.

17. (original) The hybrid power generation system of claim 1, wherein at least a portion of the cathode exhaust stream is recycled back to the cathode inlet of the fuel cell assembly.

18. (original) The hybrid power generation system of claim 1, wherein the anode exhaust stream comprises carbon monoxide, unreacted fuel, carbon dioxide and water.

19. (withdrawn) The hybrid power generation system of claim 18, further comprising a separation unit to separate the carbon dioxide from the anode exhaust stream.

20. (original) The hybrid power generation system of claim 1 wherein the fuel is selected from the group consisting of natural gas, methane, aviation fuels, propane, n-heptane, diesel, kerosene, gasoline, and coal derived fuel gas.

21. (withdrawn) A method of operating a hybrid power generation system comprising the steps of:

supplying an oxidant flow to an inlet of a fuel cell assembly, the fuel cell assembly comprising a plurality of fuel cells;

supplying a fuel to the inlet of the fuel cell assembly;

reacting electrochemically said fuel with said oxidant to produce electricity, an oxygen depleted exhaust oxidant stream and a low heat content fuel stream;

introducing said low heat content fuel stream into a tail gas burner;

controlling the oxygen depleted oxidant flow into the tail gas burner for mixing with said low heat content fuel stream to promote combustion and producing a hot gas; and

introducing the hot gas into a gas turbine to generate electricity.

22. (withdrawn) The method of claim 21, wherein the heat content of the low heat content fuel is less than or equal to about 250 BTU per cubic feet at standard conditions.

23. (withdrawn) The method of claim 21, wherein the exhaust oxidant stream comprises oxygen at less than about 25 percent of the volume of the exhaust oxidant stream.

24. (withdrawn) The method in claim 21, further comprising pre-reforming the fuel in a pre-reformer prior to sending the fuel to the fuel cell assembly.

25. (withdrawn) The method in claim 24 further comprising recirculating at least a portion of the low heat content fuel stream into the inlet of the pre-reformer.

26. (withdrawn) The method in claim 21, wherein the fuel cell is a solid oxide fuel cell.

27. (previously presented)A hybrid power generation system for generating electrical power comprising:

a compressor for producing compressed air;

a recuperator in flow communication with said compressor;

a solid oxide fuel cell assembly comprising a plurality of solid oxide fuel cells in flow communication with said recuperator to provide the compressed air for said solid oxide fuel cell assembly, said fuel cell assembly further comprising a cathode inlet for receiving the compressed air, an anode inlet for receiving a fuel stream, an anode outlet in flow communication with an anode exhaust stream and a cathode outlet in flow communication with a cathode exhaust stream; wherein at least a portion of the fuel stream reacts with the air to produce electrical power;

a tail gas burner in fluid communication with the anode outlet and the cathode outlet; said tail gas burner configured for combusting a mixture of at least a portion of the anode exhaust stream and at least a portion of the cathode exhaust stream and producing a hot compressed gas, wherein the tail gas burner comprises a primary zone and a secondary zone;

a control system for controlling the amount of the cathode exhaust stream introduced in the tail gas burner for stable combustion and reduction of fuel and carbon monoxide emission, wherein less than 20 percent of the cathode exhaust stream by mass is diverted to the primary zone of the tail gas burner and about 5 percent to about 100 percent of the cathode exhaust stream by mass is diverted to the secondary zone of the tail gas burner; and

a turbine for expanding said hot compressed gas and producing electrical power and an expanded gas.

9. APPENDIX OF EVIDENCE

None.

10. APPENDIX OF RELATED PROCEEDINGS

None.